Amendment to Drawing:

The attached replacement sheet includes a change to FIG. 2. This sheet, which includes FIG. 2, replaces the original sheet that included FIG. 2.

In FIG. 2, the previous unit of "dBm" for the output power axis has been replaced by "dB". The unit "dB" is a standard unit known to those of ordinary skill in the art. It is submitted that for this change, there is no new matter entered.

Attachment: One Replacement Sheet

REMARKS

Drawings

The drawings are objected to because the unit of "dBm" on the graph in FIG. 2 is not a measure of output power.

In response to this objection, applicants have amended FIG. 2 by changing the unit "dBm" to the unit "dB". It is believed that the objection to FIG. 2 is now overcome.

Claim Rejections under 35 U.S.C. 101

Claims 1-12 are rejected under 35 U.S.C. 101 because the disclosed invention is inoperative and therefore lacks utility.

In response to these rejections, applicants have amended independent claims 1, 6 and 9 to clarify the nature of the broadband light source claimed. Applicants have also amended paras. [0008] and [0018] of the specification and the Abstract to clarify the nature of embodiments of the broadband light source of the present invention. Applicants claim a broadband light source which operates akin to an amplified spontaneous emission (ASE) light source. As explained in Falquier et al (US 6,429, 965), an ASE exhibits, among other things, amplification characteristics (col. 1, lines 51-51; col. 2, lines 32-34). However, applicants merely claim generation of spontaneous-radiation light within the fiber when the fiber is excited by the input pump light, as described in paragraph [0014] of the specification as originally filed. In a typical embodiment, pump light having a wavelength of 980 nm excites the fiber to produce broadband light having a wavelength of 1550 nm (see para. [0016] of the specification as originally filed).

In other words, the present invention is akin to an amplified spontaneous emission (ASE) light source, the present invention being distinguished in that it can provide double bandwidth output and minimize power loss. Yan et al (US 5,982,973) relates to a planar optical waveguide device, especially an optical amplifier. In an optical amplifier, a separate pump light causes an input signal light to be amplified. In an ASE type light source, an erbium-doped optical fiber generates ASE light from incident pumping light. The principles of operation of the optical amplifier of Yan (a signal light being amplified by applying a pump light) do not undermine the principles of operation of the broadband light source of the present invention (a pump light being applied to produce spontaneous-radiation light).

Therefore the utility of the present invention is specific, substantial, and credible. A person of ordinary skill in the art would appreciate the invention is useful based on the described and claimed characteristics. In summary, it is submitted that the present invention is operative and has a utility.

Claim Rejections under 35 U.S.C. 112

Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

Applicants refer to and rely on the above assertions made regarding the utility of claims 1-12 under 35 U.S.C. 101. For similar reasons, applicants respectfully submit that the specification enables one skilled in the art to make and/or use the invention. In particular, Applicants claim a broadband light source which operates akin to an amplified spontaneous emission (ASE) light source. Spontaneous-radiation light is generated within the lanthanide-doped fiber when the fiber is excited by the input pump light, as described in paragraph [0014] of the specification as originally filed. In a typical embodiment, pump light having a

wavelength of 980 nm excites the fiber to produce broadband light having a wavelength of 1550 nm (see para. [0016] of the specification as originally filed).

Claim 11 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement.

In response, applicants have canceled claim 11 without prejudice.

Claim Rejections under 35 U.S.C. 103

Claims 1 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Falquier et al. (US 6,429,965) in view of Hecht.

In response, applicants respectfully traverse for the following reasons:

Claims 1 and 6 recite a broadband light source which includes a pump laser, a lanthanide series element-doped fiber (claim 1) or an erbium-doped fiber (claim 6), a WDM device, and a first and a second optical isolators. **The fiber has a predetermined length**. The WDM has at least three ports, and a first and a second port of the at least three ports respectively connect with the pump laser and the fiber. The first isolator connects with the third port of the WDM device, and **the second isolator connects with the fiber**. The pump light is coupled to the fiber by the WDM device. The pump light excites spontaneous-radiation light within the fiber. **A part of the spontaneous-radiation light directly passes through the second optical isolator and is exported. A remaining part of the spontaneous-radiation light is reflected and coupled to the first isolator by the WDM device and is exported**.

Falquier discloses a superfluorescent source which includes an optical coupler, a doped fiber, and an isolator. Falquier describes that one end 1470 of the pump output end of the EDF 118' of Fig. 16 is optically terminated (see col. 19, lines 40-45). That is, Falquier fails to disclose that the distal end of the fiber 118' is an export path. Indeed, Falquier explicitly specifying and illustrating a termination

teaches against the opposite configuration whereby there is no termination. Therefore it is submitted to be improper to characterize the fiber 118' as having an output that routes outputted light.

Further, Falquier fails to disclose a second isolator. Although Hecht teaches that isolators are commonly used at the output of amplifiers in order to mitigate Brillouin scattering, neither Hecht nor Falquier in view of Hecht teaches or suggests having a double-port output. A person of ordinary skill in the art would not have derived the broadband light source of the present invention from a consideration of Falquier in view of Hecht.

For at least the above reasons, applicants submit that Falquier in view of Hecht do not teach or suggest the invention as currently set forth in claims 1 and 6. Claims 1 and 6 are submitted to be unobvious and patentable under 35 U.S.C. 103 over Falquier in view of Hecht.

Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Falquier et al. (US 6,429,965) in view of Hecht.

In response, applicants refer to and rely on the above assertions regarding patentability of claim 1 under 35 U.S.C. 103 over Farquier in view of Hecht. For similar reasons, claims 2 and 5 are submitted to be patentable under 35 U.S.C. 103 over Farquier in view of Hecht.

Claims 3-4 and 8-9 are stated to be rejected under 35 U.S.C. 103(a) as being unpatentable over Falquier et al. (US 6,429,965) in view of Hecht as applied to claim 1 above, and further in view of Agrawal and Hwang (US 6,252,700).

In response, applicants acknowledge that Agrawal discloses a relationship between output power and input power (see pages 55-56). Reference is made to page 55, especially the equation 2.5.2, $P_{out}=P_{in}\exp(-\alpha L)$, wherein α is the attenuation coefficient, and L is a fiber of length L. However, α is affected by

not only material absorption but also other sources of power attenuation. Accordingly, the effects of L on the output power are not clear.

Agrawal's contents from pages 226-260 are related to optical amplifiers. However, optical amplifiers operate differently from ASE type sources, because an ASE source does not have an optical signal input. In other words, an ASE source is not subject to the effects associated with an input signal light.

Further, even considering the information of pages 226-260 of Agrawal on its face, Agrawal does not provide substantial teaching or suggestion in relation to the features of claims 3-4 and 8-9 herein.

Agrawal discloses that "the optical gain, in general, depends not only on the frequency (or wavelength) of the incident signal, but also on the local beam intensity at any point inside the amplifier. Details of the frequency and intensity dependence of the optical gain depend on the amplifier medium" (see page 226). In addition, Agrawal on pages 226-228 and 229 and in sections 6.4.4 and 6.4.5 provides disclosures that are basically related with the wavelength of the transmitted light; see especially the various units in figure 6.15. However, Agrawal does not disclose a relationship among power or gain with a length of a fiber.

Agrawal discloses the phenomenon of gain saturation on page 229, whereby the amplification factor G decreases with an increase in the signal power. However, Agrawal does not disclose the relationship between gain and a length of the fiber.

Agrawal discloses erbium-doped fiber amplifiers (EDFA) in sections 6.4.4 and 6.4.5. However, Agrawal states that the gain of an EDFA depends on a large number of device parameters such as erbium ion concentration, amplifier length, core radius, and pump power (see page 253). That is, among other things, amplifier length and pump power determine the value of the gain. However,

Agrawal does not disclose a relationship between the output power and a length of the fiber.

Hwang is related to erbium doped fiber amplifier suitable for long wavelength light signals. Hwang's optical amplifier is different from an ASE type source, and the teachings of Hwang do not necessarily apply in relation to an ASE type source such as the presently claimed broadband light source. In any event, Hwang discloses that an isolator 38 is disposed between EDFs 36 and 40 in order to obtain a high gain and low noise. Hwang is directed to solving the problem whereby an amplified ASE light lowers the amplifying efficiency of a light signal (see column 3, lines 55-65). That is, Hwang is directed to preventing the ASE light from being amplified, and to this end Hwang employs the isolator 38. The problem Hwang realizes is the role of the isolator 38 in reducing or preventing ASE light from being amplified in an optical amplifier. However, the present invention is directed to obtaining a fiber having a predetermined length whereby output power at two ends of a broadband light source is the same. Therefore, Hwang's teachings are directed toward solving a problem different from the problem being addressed by the present invention. Even if it can be said that Hwang has identified the problem of amplifier gain as a function of isolator placement, such identification does not substantially contribute toward solving the problem addressed by the present invention.

Accordingly, it is submitted that each of Agrawal and Hwang fails to disclose or suggest a relationship between length of the fiber and loss in a broadband light source. Further, one of ordinary skill in the art cannot simply take various components and combine them without a commonality of purpose or characteristics that gives the artisan some reasonable expectation of success. **Yamanouchi Pharmaceutical Co., Ltd. v. Danbury Pharmacal, Inc., 231 F.3d 1339, 56 U.S.P.Q.2d 1641 (Fed. Cir. 2000).** That is, applicants submit

that there is no motivation to combine either or both of Agrawal and Hwang with Falquier in view of Hecht in order to arrive at the presently claimed invention. The present invention makes use of the **erbium-doped fiber's predetermined length** being such that first and second optical isolators can achieve a same output optical power. This feature provides a hitherto unappreciated advantage of a light source having two output ports instead of light power being wasted at one end of the light source.

Thus, claims 3-4 and 8 are submitted to be patentable under 35 U.S.C. 103 over Farquier in view of Hecht and further in view of Agrawal and Hwang.

If further argument is necessary, applicants refer to and rely on the above assertions regarding patentability of claim 1 under 35 U.S.C. 103 over Falquier et al. (US 6,429,965) in view of Hecht. Applicants respectfully submit that Agrawal and Hwang do not provide any additional teaching to the teachings of Falquier et al. (US 6,429,965) in view of Hecht which might lead one of ordinary skill in the art to provide the broadband light source of claim 1. That is, claim 1 is submitted to be unobvious and patentable over Falquier, Hecht, Agrawal and Hwang. On this basis, claims 3-4 and 8 should be patentable as being dependent on independent claim 1.

Moreover, the very fact that as many as four references are cited to support the combination rejection of claims 3-4 and 8 is, in addition to the above assertions, further probative of unobviousness.

In summary, claims 3-4 and 8 are submitted to be unobvious and patentable under 35 U.S.C. 103 over Falquier in view of Hecht and further in view of Agrawal and Hwang.

Regarding claim 9, this recites a broadband light source which includes a pump laser, a lanthanide series element-doped fiber, a WDM device, and a first and a second optical isolators. **The fiber has a predetermined length**. The WDM

has at least three ports, and a first and a second port of the at least three ports respectively connect with the pump laser and the fiber. The first isolator connects with the third port of the WDM device, and the second isolator connects with the fiber. The pump light is coupled to the fiber by the WDM device. The pump light excites spontaneous-radiation light within the fiber. A forward spontaneous-radiation light directly passes through the second optical isolator and is exported. A backward spontaneous-radiation light is reflected and coupled to the first isolator by the WDM device and is exported. **The predetermined length of the doped fiber is such that the first and second optical isolators can achieve a same output optical power**.

Falquier describes that one end 1470 of the pump output end of the EDF 118' of Fig. 16 is optically terminated (see col. 19, lines 40-45). That is, Falquier fails to disclose that the distal end of the fiber 118' thereof is an export path. Indeed, Falquier explicitly specifying and illustrating a termination teaches against the opposite configuration whereby there is no termination. Therefore it would be improper to characterize the fiber 118' as having an output that routes outputted light.

Accordingly, Falquier fails to disclose or teach that the predetermined length of the doped fiber is such that the first and second optical isolators of the presently claimed invention can achieve a same output optical power.

Further, Falquier fails to disclose a second isolator. Although Hecht teaches that isolators are commonly used at the output of amplifiers in order to mitigate Brillouin scattering, neither Hecht nor Falquier in view of Hecht teaches or suggests having a double-port output. A person of ordinary skill in the art would not have derived the broadband light source of the present invention from a consideration of Falquier in view of Hecht.

Applicants acknowledge that Agrawal discloses a relationship between output power and input power (see pages 55-56). Reference is made to page 55,

especially the equation 2.5.2, $P_{out}=P_{in}\exp(-\alpha L)$, wherein α is the attenuation coefficient, and L is a fiber of length L. However, α is affected by not only material absorption but also other sources of power attenuation. Accordingly, the effects of L on the output power are not clear.

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Agrawal discloses that "the optical gain, in general, depends not only on the frequency (or wavelength) of the incident signal, but also on the local beam intensity at any point inside the amplifier. Details of the frequency and intensity dependence of the optical gain depend on the amplifier medium" (see page 226). In addition, Agrawal on pages 226-228 and 229 and in sections 6.4.4 and 6.4.5 provides disclosures that are basically related with the wavelength of the transmitted light; see especially the various units in figure 6.15. However, Agrawal does not disclose a relationship among power or gain with a length of a fiber.

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core radius, and pump power (see page 253). That is, among other things, amplifier length and pump power determine the value of the gain. However, Agrawal does not disclose a relationship between the output power and a length of the fiber.

Hwang is related to erbium doped fiber amplifier suitable for long wavelength light signals. Hwang's optical amplifier is different from an ASE type source, and the teachings of Hwang do not necessarily apply in relation to an ASE type source such as the presently claimed broadband light source. In any event, Hwang discloses that an isolator 38 is disposed between EDFs 36 and 40 in order to obtain a high gain and low noise. Hwang is directed to solving the problem whereby an amplified ASE light lowers the amplifying efficiency of a light signal (see column 3, lines 55-65). That is, Hwang is directed to preventing the ASE light from being amplified, and to this end Hwang employs the isolator 38. The problem Hwang realizes is the role of the isolator 38 in reducing or preventing ASE light from being amplified in an optical amplifier. However, the present invention is directed to obtaining a fiber having a predetermined length whereby output power at two ends of a broadband light source is the same. Therefore, Hwang's teachings are directed toward solving a problem different from the problem being addressed by the present invention. Even if it can be said that Hwang has identified the problem of amplifier gain as a function of isolator placement, such identification does not substantially contribute toward solving the problem addressed by the present invention.

Accordingly, it is submitted that each of Agrawal and Hwang fails to disclose or suggest a relationship between length of the fiber and loss in a broadband light source. Further, one of ordinary skill in the art cannot simply take various components and combine them without a commonality of purpose or characteristics that gives the artisan some reasonable expectation of success.

Yamanouchi Pharmaceutical Co., Ltd. v. Danbury Pharmacal, Inc., 231 F.3d 1339, 56 U.S.P.Q.2d 1641 (Fed. Cir. 2000). That is, applicants submit that there is no motivation to combine either or both of Agrawal and Hwang with Falquier in view of Hecht in order to arrive at the presently claimed invention. The present invention makes use of the **erbium-doped fiber's predetermined length** being such that first and second optical isolators can achieve a same output optical power. This feature provides a hitherto unappreciated advantage of a light source having two output ports instead of light power being wasted at one end of the light source.

Moreover, the very fact that as many as four references are cited to support the combination rejection of claim 9 is, in addition to the above assertions, further probative of unobviousness.

In summary, claim 9 is submitted to be unobvious and patentable under 35 U.S.C. 103 over Falquier in view of Hecht and further in view of Agrawal and Hwang.

Claims 10 and 12 depend directly from independent claim 9. Accordingly, claims 10 and 12 should also be unobvious and patentable under 35 U.S.C. 103 over Falquier in view of Hecht and further in view of Agrawal and Hwang.

Finally, applicants respectfully traverse the finality of the current Office action. In section 7. on p.3, it is stated that the new grounds of rejection were necessitated by an amendment to claims 1 and 6 which changed their scope. Applicants submit that the addition of the word 'through' to claim 1 did not change the substance of the scope of the claim. The addition merely explicitly stated what would necessarily be understood by one of ordinary skill in the art from a reading of the claim in light of the specification and drawings (see esp. FIG. 1) as

originally filed. Applicants also submit that the addition of the word 'and' to claim 6 was a mere formality, and did not change the substance of the scope of the claim. Applicants further submit that the addition of the word 'through' to claim 6 did not change the substance of the scope of the claim. The addition merely explicitly stated what would necessarily be understood by one of ordinary skill in the art, from a reading of the claim in light of the specification and drawings (see esp. FIG. 1) as originally filed. For at least these reasons, Applicants respectfully request that the finality of the current Office action be withdrawn.

In view of the above amendments and remarks, the subject application is believed to be in a condition for allowance, and an action to such effect is earnestly solicited.

Respectfully submitted,
Lin et al.

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